

## CLAIMS

What is claimed is:

- 1           1.     A method comprising:  
2                 classifying an incoming packet into one of a plurality of flows;  
3                 determining an estimate of a load of the plurality of flows on a scarce  
4 resource; and  
5                 implementing a drop policy for at least one flow when the estimate  
6 exceeds a predicted threshold.
- 1           2.     The method of Claim 1 wherein determining comprises:  
2                 aggregating a cost estimate of all packets within a flow to generate a flow load  
3 estimate for each flow; and  
4                 summing the individual flow load estimates to yield a total load  
5 estimate.
- 1           3.     The method of Claim 1 further comprising:  
2                 allocating a portion of the scarce resource to each flow of an expected  
3 plurality of flows.
- 1           4.     The method of Claim 3 further comprising:  
2                 identifying which flows of the plurality of flows exceeds their  
3 allocation.
- 1           5.     The method of Claim 4 further comprising:  
2                 distributing excess capacity from flows that do not exceed their  
3 allocation to those flows that exceed their allocation.
- 1           6.     The method of Claim 1 wherein implementing comprises:  
2                 computing a reduction factor based on aggregate over utilization of the  
3 processor.

1           7.     The method of Claim 1 wherein implementing a drop policy  
2 comprises:

3                 accessing a location in a drop buffer;  
4                 dropping a current packet if the location has a first value;  
5                 serving the current packet if the location has a second value; and  
6                 advancing a buffer pointer to point to a next buffer location.

1           8.     The method of Claim 1 wherein the drop policy is established on a flow  
2 by flow basis.

1           9.     The method of Claim 1 wherein determining comprises:  
2                 generating a cost factor for an incoming packet based on at least one of  
3 packet type and packet length.

1           10.    The method of Claim 6 wherein computer comprises:  
2                 determining a total under utilization by flow not exceeding an expected  
3 load on the scarce resource;  
4                 adding the total under utilization to an expected load of excessive  
5 flows; and  
6                 dividing the sum by an offered load of excessive flows.

1           11.    The method of Claim 1 further comprising:  
2                 decreasing the predicted threshold if the scarce resource is over utilized  
3 when the load is equal to the predicted threshold; and  
4                 increasing the predicted threshold if the scarce resource is under  
5 utilized at the predicted threshold.

1           12.    The method of Claim 11 wherein each decrease has a greater absolute  
2 value than each increase.

1           13.    A computer readable storage media containing executable computer  
2 program instructions which when executed cause a digital processing system to  
3 perform a method comprising:

4                   classifying an incoming packet into one of a plurality of flows;  
5                   determining an estimate of a load of the plurality of flows on a scarce  
6 resource; and  
7                   implementing a drop policy for at least one flow when the estimate  
8 exceeds a predicted threshold.

1           14.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3                   aggregating a cost estimate of all packets within a flow to generate a  
4 flow load estimate for each flow; and  
5                   summing the individual flow load estimates to yield a total load  
6 estimate.

1           15.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3                   allocating a portion of the scarce resource to each flow of an expected  
4 plurality of flows.

1           16.    The computer readable storage media of Claim 15 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3                   identifying which flows of the plurality of flows exceeds their  
4 allocation.

1           17.    The computer readable storage media of Claim 16 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3                   distributing excess capacity from flows that do not exceed their  
4 allocation to those flows that exceed their allocation.

1           18.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3                   computing a reduction factor based on aggregate over utilization of the  
4 processor.

1           19.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3           accessing a location in a drop buffer;  
4           dropping a current packet if the location has a first value;  
5           serving the current packet if the location has a second value; and  
6           advancing a buffer pointer to point to a next buffer location.

1           20.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3           the drop policy is established on a flow by flow basis.

1           21.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3           generating a cost factor for an incoming packet based on at least one of  
4 packet type and packet length.

1           22.    The computer readable storage media of Claim 18 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3           determining a total under utilization by flow not exceeding an expected  
4 load on the scarce resource;  
5           adding the total under utilization to an expected load of excessive  
6 flows; and  
7           dividing the sum by an offered load of excessive flows.

1           23.    The computer readable storage media of Claim 13 which when  
2 executed cause a digital processing system to perform a method further comprising:  
3           decreasing the predicted threshold if the scarce resource is over utilized  
4 when the load is equal to the predicted threshold; and  
5           increasing the predicted threshold if the scarce resource is under  
6 utilized at the predicted threshold.

1           24.    The computer readable storage media of Claim 23 wherein each  
2 decrease has a greater absolute value than each adjustment upward.

1           25.    An apparatus comprising:  
2                a network input interface; and  
3                a processor coupled to the input interface and having a capacity, the  
4 processor to implement a drop policy at the input interface when aggregate  
5 utilization of the processor by a plurality of flows exceeds a threshold.

1           26.    The apparatus of Claim 25 further comprising:  
2                a memory coupled to the processor to store a drop buffer, the drop  
3 buffer populated to simulate randomization of drop events based on a drop factor.

1           27.    The apparatus of Claim 26 wherein the memory stores a cyclic buffer  
2 corresponding to each supported reduction factor.

1           28.    The apparatus of Claim 25 wherein the processor implements a packet  
2 to flow classification algorithm to group incoming packets into flows.

1           29.    The apparatus of Claim 25 wherein the threshold is approximately  
2 equal to the capacity.